# Biosafety Issues and Strategy in the Western Pacific Region

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# Laboratory-Acquired SARS Outbreaks

- Singapore September 2003
- Taiwan (China) December 2003
- Beijing and Anhui (China) March 2004

# Laboratory-Acquired Case of SARS Singapore, September 2003

- Patient: 27-year-old graduate student
- Place of infection: BSL-3 lab., Environmental Health Institute
- Onset of illness: Aug. 26, 2003
- Hospitalization: Sept. 3, 2003
- Confirmed day: Sept. 8, 2003

# Summary of the investigation
## Singapore

- The patient most likely acquired the infection in BSL-3 laboratory in the Environmental Health Institute where he had worked
- Inappropriate laboratory procedures and a cross contamination of West Nile virus samples with SARS-CoV in the laboratory led to the infection of the doctoral student
- The results of the genome sequencings on the laboratory strain of SARS-CoV and that of the patient's were found to be closely related
- No evidence could be found of any other source of infection
- There is no evidence of secondary transmission case

# Assessment of BSL-3,2 Laboratories in Singapore

Other laboratories in Singapore were assessed and recommendations were given regarding the construction of the facilities and laboratory management

1. Environmental Health Institute
2. Singapore General Hospital
3. National University of Singapore
4. Defense Science Organization

# Laboratory-Acquired Case of SARS Taiwan (China), Dec. 2003

- Patient: 44-year-old male lab. scientist
- Place of infection: BSL-4 lab., Institute of Preventative Medicine, National Defense Medical Center
- Onset of illness: Dec. 11, 2003
- Hospitalization: Dec. 16, 2003
- Confirmed day: Dec. 17, 2003

# Summary of the investigation
## Taiwan (China)

- He was working on SARS-CoV experiments using a BSL-4 facility at the IPM-NDMC
- He found a spillage of material in the transportation chamber and disinfected it with 70% ethanol and cleaned it manually
- The environment specimens collected from the handle of an alcohol spray bottle from the transportation chamber and the switch panel of the cabinet yielded positive results for SARS-CoV
- Isolated event : no secondary transmission

# Assessment of BSL-3,2 Laboratories in Taiwan (China)


1. Institute of Preventative Medicine, National Defense Medical Center
2. Centers for Disease Control Taiwan, Taipei Laboratories
3. NUT, Chang Gung Memorial Hospital, Taipei
4. Animal Health Research Institute, Taipei
5. National Cheng Kung University Virology Laboratory
6. Kaohsiung Medical Center, Chang Gung Memorial

# Laboratory-Acquired SARS Outbreak in China March 2004

- From March to April 2004, an outbreak of SARS involved two verified chains of SARS-CoV transmission (9 individuals) occurred in Beijing and Anhui Province, linked to the National Institute of Virology, China CDC
- The source of the outbreak is most probably failed or incomplete inactivation of SARS-CoV (cold inactivation)
- There have been three generations resulting in 9 cases
- Serological analysis on the laboratory staff revealed three more seroconverted cases and one of them is most likely to have been infected early in Feb. 2004

# Laboratory-Acquired SARS Outbreak in China March 2004

- **A (female research student) 25 March**
  - 2nd → **B (A's mother)** → **death**
  - **C (nurse attending A)**
    - 3rd → **D (C's mother)**
    - **E (C's aunt)**
    - **F (C's father)**
    - **G (retired doctor sharing hospital room with C)**
    - **H (G's daughter-in-law)**
- **I (male laboratory researcher) 17 April**

SARS IgG (+)

J (female laboratory worker in BSL-3 laboratory)
K (female laboratory worker who developed pneumonia)
L (male laboratory worker, A's supervisor)

China CDC

# Common problems

- Bad practice in laboratory management
- Poor supervision of less experienced professionals
- A lack of accountability for occupational health and safety
- A lack of biosafety policy
- A lack of biosafety procedures and staff training in biosafety practice
- A lack of internal and external quality assurance

# Recommendations

- Need for a legislative basis for Biosafety Standards for laboratories
- Procedures for timely reporting and follow-up of all unusual laboratory incidents should be developed
- Monitor workers health and instruction of countermeasures
- Accreditation and certification of BSL-3 laboratories should be implemented
- Inventory of infectious agent

# Increasing number of BSL-3 laboratories

China CDC

NIHE (Viet Nam)


Xiamen CDC


Guiyang CDC

# Assessment of BSL-3 Laboratories & Biosafety Training Program in Viet Nam

# Biosafety training course in Viet Nam

- Institution: The National Institute of Hygiene and Epidemiology (NIHE) in Hanoi, Viet Nam
- Duration: 16 to 20 August 2004
- Instructors: Dr. Kazuyoshi SUGIYAMA, Chief, Division of Biosafety Control and Research, National Institute of Infectious Control (NIID), Japan

  Dr. Nguyen Viet Hung, Head of infection Control Department, Bach Mai Hospital, Hanoi, Viet Nam

# Lecture

**I. Principle of Biosafety**

1. Biohazard/Biosafety
2. Historical background of biosafety
3. Laboratory acquired infection
4. Significance of aerosol/spray factor
5. Principles of biosafety
6. Biosafety level
7. BSL-2-4 laboratories
8. Countermeasure for accident

**II. Management system of pathogens in NIID**

1. Regulations
2. Laboratory safety management
3. Training and education
4. Relationship to local community (residents)

**III. Biosecurity and international tendency of biosafety**

# Practice and Laboratory Evaluation

## Practice of Biosafety

1. Proper use Biological Safety cabinet
2. Disinfection / Disinfectant
3. Transportation of pathogenic agents

## Laboratory Evaluation

1. Biological hazard area, BSL-3 laboratory
2. Respiratory virus laboratory
3. Enteric virus laboratory
4. Bacteriology laboratory
5. BSL-1 laboratory

# Biosafety Enhancement Training Workshop for Southeast Asia and China

**14 to 18 March 2005**

sponsored by

**Singapore Ministry of foreign Affairs**

and the

**Canadian International Development Agency (CIDA)**

under the auspices of the

**Singapore-Canada Third Country Training Programme**

to be jointly conducted by

**The Public Health Agency of Canada**

and

**TEMASK Lifesciences Laboratory**

# Speakers and Participants

- Speakers

  Maureen Best

  Kenneth Ugwu

  Chua TM

  Phillipe Dubois

  Futoshi Hasebe

- Participants

| | |
|---|---|
| **Brunei** | **MoH 2, MoA 2** |
| **Cambodia** | |
| **China** | |
| **Indonesia** | |
| **Lao-PDR** | |
| **Philippines** | |
| **Malaysia** | |
| **Myanmar** | |
| **Thailand** | |
| **Vietnam** | |
| **Singapore** | |

# Lecture and Practice

- National Biosafety Strategy
- WHO Biosafety Program and Collaborating Centers
- Asia-Pacific Biosafety Association
- Regional Emerging Disease Intervention Center
- Introduction to Biosafety and Biocontainment
- Design of Laboratory Containment Facilities
- Biological Safety Cabinets
- Certification and Recertification
- Containment Facility
- BSL-3 Tour
- Operational Biosafety Practices
- Disinfection/Decontamination
- Facility Operation and Maintenance
- Animal Facility Design
- Working with Animals in Containment
- Biosecurity
- Risk Assessment for Biohazard
- Transportation of Infectious Materials
- Emergency Response to Biological Incidents
- Biosafety Program Management
- Regional Biosafety Strategy
- Gaps in National Laboratory Capacities
- EsTablishing a SEAsia Laboratory Network

# Who is handling SARS-CoV?

## As of 4 April 2005: 1018 (657)

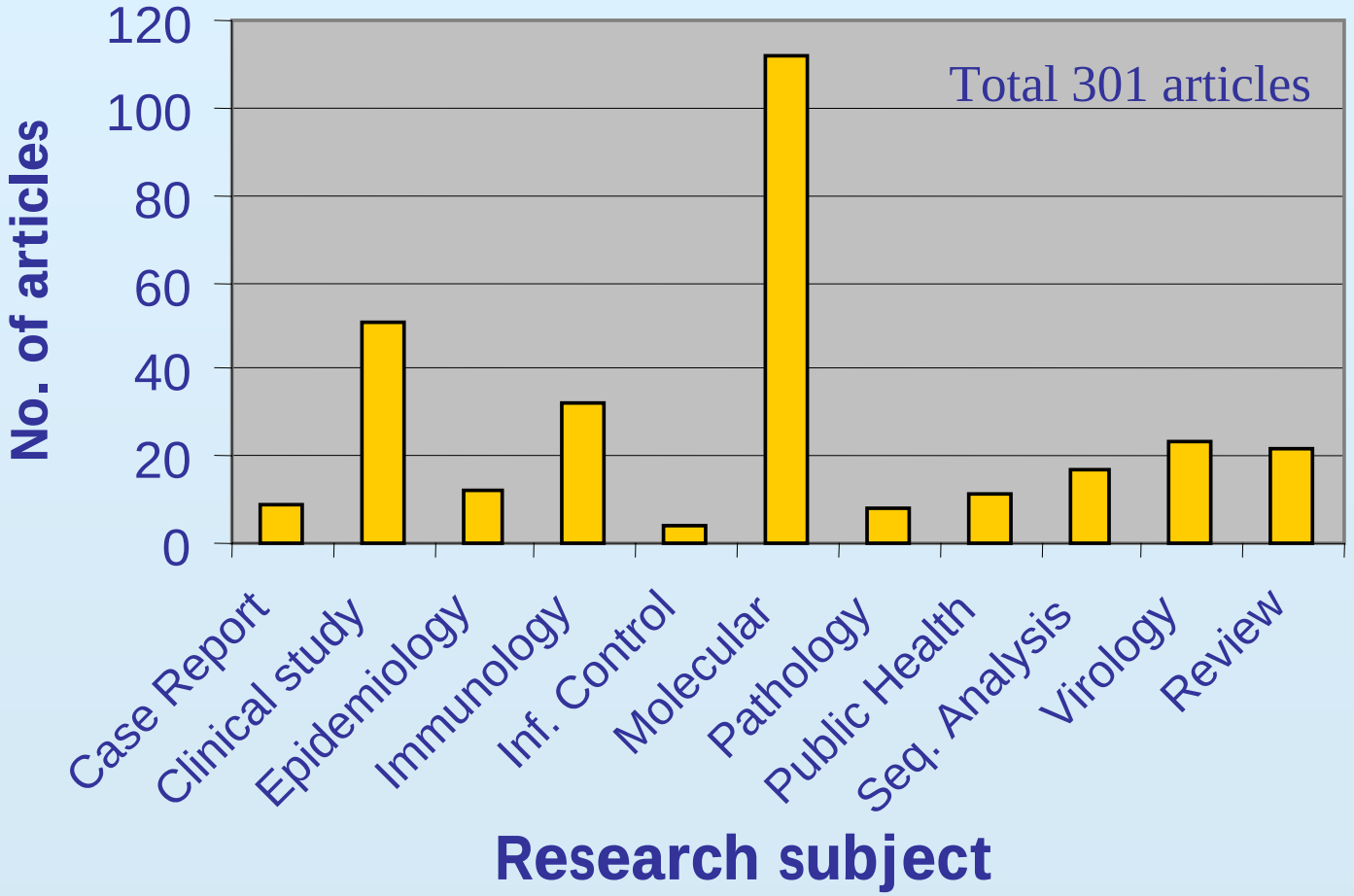
| | | | |
|---|---|---|---|
| Australia | 5 | Japan | 15 |
| Belgium | 3 | Netherland | 16 |
| Canada | 34 | Poland | 3 |
| China | 301 | Russia | 4 |
| Denmark | 1 | Singapore | 35 |
| France | 5 | Spain | 7 |
| Germany | 32 | Sweden | 2 |
| Greece | 1 | Switzerland | 2 |
| India | 4 | Taiwan | 41 |
| Ireland | 1 | Thailand | 2 |
| Israel | 5 | UK | 16 |
| Italy | 6 | USA | 116 |

# SARS-CoV Related Studies Conducted in the Western Pacific Region

| Country | Publications |
|---|---|
| Australia | 5 |
| China | 301 |
| Japan | 15 |
| Singapore | 35 |
| Taiwan (China) | 41 |
| Total | 397 |

(397/657 = 60.4%)

# SARS-CoV Related Studies in China



## China

1. Chen WQ — Serology
   Sun Yat-Sen University, Guangzhou, People's Republic of China
2. Liu B, Zhou J. — Molecular Biology (modelling)
   State Key Laboratory of Biochemical Engineering, Institute of Process Engineering, Chinese Academy of Sciences Beijing 100080, People's Republic of China.
3. Zhong N, Huang Q, Jin C, Xia B. — Molecular Biology
   Beijing Nuclear Magnetic Resonance Center, P.R. China.
4. Chen Z, Mi L, Xu J, Yu J, Wang X, Jiang J, Xing J, Shang P, Qian A, Li Y, Shaw PX, Wang J, Duan S, Ding J, Fan C, Zhang Y, Yang Y, Yu X, Feng Q, Li B, Yao X, Zhang Z, Li L, Xue X, Zhu P. — Molecular Biology
   Department of Cell Biology, the Fourth Military Medical University, Xi'an, China.
5. Li JN, Xiang KJ, Zhou R, Huang CH, — Molecular Biology (DNA vaccine)
   Southern China University of Tropical Agriculture, Danzhou 571737, China.
6. Yu C, Gui C, Luo H, Chen L, Zhang L, Yu H, Yang S, Jiang W, Shen J, Shen X, Jiang H. — Molecular Biology (modelling)
   Drug Discovery and Design Center, State Key Laboratory of Drug Research, Shanghai Institute of Materia Medica, Shanghai Institutes for Biological Sciences, Graduate School, Chinese Academy of Sciences, Shanghai 201203, China, Shanghai Institute of Plant Physiology and Ecology, Shanghai Institutes for Biological Sciences, Graduate School, Chinese Academy of Sciences, 300 Fenglin Road, Shanghai 200032, China, and School of Pharmacy, East-China University of Science and Technology, Shanghai 200237, China.

# Biosafety activity plans in China in 2005

Dr Helene Fredlund: seconded to WHO from Swedish Institute of Infectious Diseases (SMI)

1. Assessment of biosafety and “Hands on training”
2. Development of laboratory database
3. Training for laboratory managers in biosafety
4. International conference on biosafety

# Inventory of Pathogens in Japan

Ministry of Health, Labour and Welfare,
Japan

# Questionnaire survey for possession of pathogens in Japan in Dec 2004

| Virus | |
|---|---|
| Small pox | 0 |
| SARS-CoV | 5 |
| Ebola virus | 0 |
| Marburg virus | 0 |
| Lassa virus | 0 |
| Polio virus | 25 |

| Bacteria | |
|---|---|
| Vibrio cholerae | 300 |
| Bacillus dysenteria | 543 |
| Salmonella typhi | 358 |
| Yersinia pestis | 13 |

| Bacteria toxin | |
|---|---|
| Cholera toxin | 17 |
| Shigella toxin | 6 |

587 facilities possessed the pathogens among 11,624 investigated facilities

# The situation of storage management for pathogens in Japan in Dec 2004

| | Inventory location | | | |
|---|---|---|---|---|
| | Consolidate | Sectral | Unknown | Others |
| Medical Institutions | 98 | 93 | 3 | 43 |
| Research Institutions | 94 | 77 | 2 | 23 |
| Public Institutions | 82 | 16 | 1 | 22 |
| Others | 21 | 11 | 0 | 1 |
| Total | 295 | 197 | 6 | 89 |

# The situation of storage management for pathogens in Japan in Dec 2004

| | Administration method | | | Storage Manual | |
|---|---|---|---|---|---|
| | Computerize | Register | Others | Yes | No |
| Medical Institutions | 41 | 163 | 30 | 89 | 148 |
| Research Institutions | 15 | 167 | 12 | 121 | 75 |
| Public Institutions | 7 | 110 | 3 | 70 | 51 |
| Others | 4 | 27 | 2 | 30 | 3 |
| Total | 67 | 467 | 47 | 310 | 277 |

# WPRO support to countries and reported diseases in 2003 &2004

# Laboratory Assessment in Malaysia and Lao-PDR

## Malaysia

- Reference Lab:
  - National Public Health Lab (NPHL)
  - Institute of Medical Research (IMR)
    - Virology Units
    - Bacteriology Units
- Intermediate Lab:
  - Provincial Hospital Lab
    - Ipoh
    - Johor Bahru
  - State Hospital Lab
    - Ipoh
    - Johor Bahru (HSA)
    - Kota Bahru Kelantan
- Peripheral (District Hospital Lab)
    - Mersing Hospital Lab
    - Tumpat Hospital Lab

## Lao-PDR

- Reference Lab:
  - National Center for Laboratory and Epidemiology (NCLE)
- Intermediate Lab (Provincial Lab):
  - Savannakhet Hospital Lab
  - Luang Prabang Hospital Lab
  - Luang Namtha Hospital Lab
- Peripheral (District Hospital Lab):
  - Sepol District Hospital

# Biosafety situations in BSL-1 & 2


# Module-2. Biosafety, Hygiene and Security

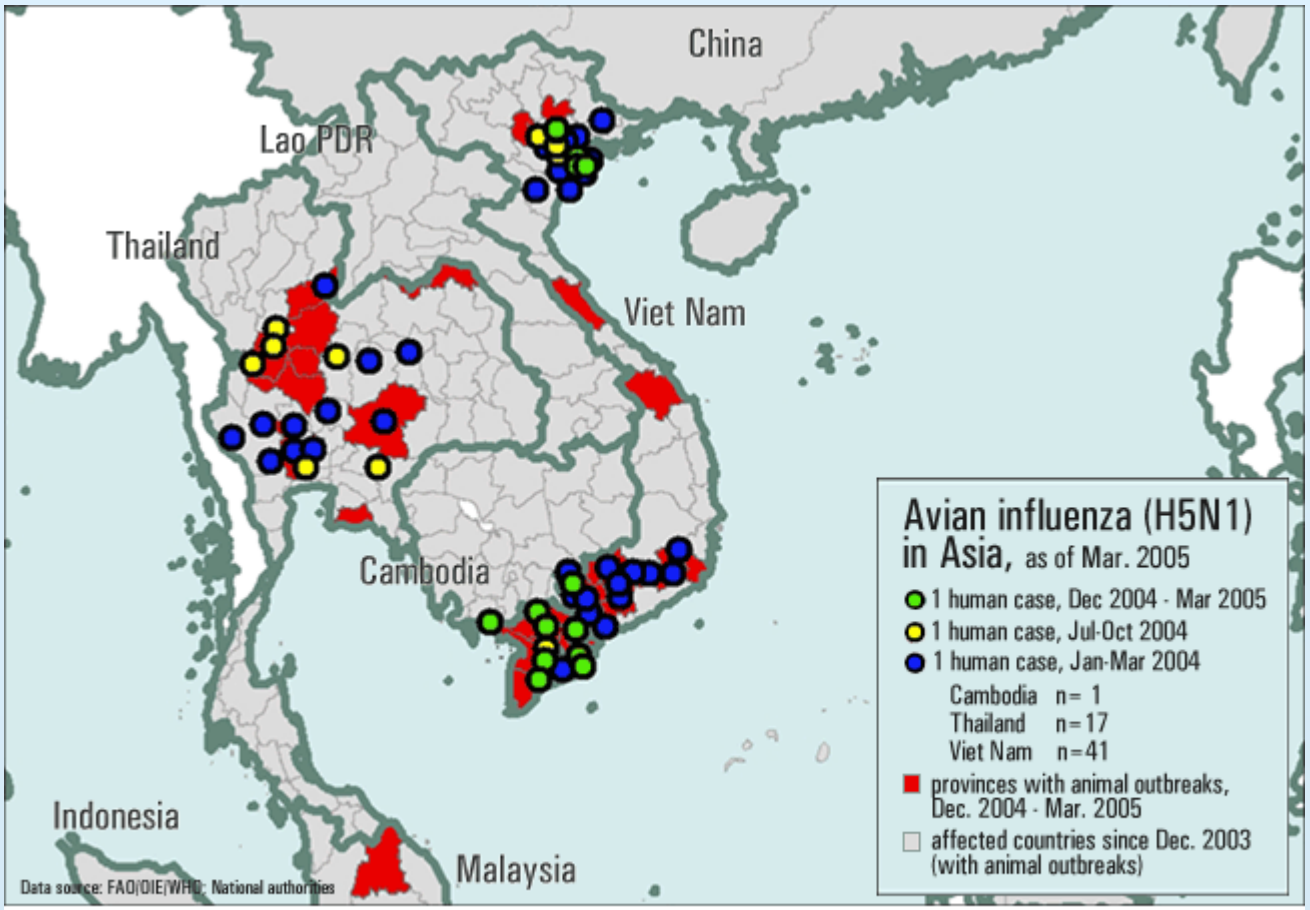
| Malaysia | Assessment Score (%) |
|---|---|
| IMR Bact. | 76 |
| IMR Virol. | 83 |
| NPHL | 82 |
| RHL Ipo | 81 |
| RHL JB | 36 |
| SHL Ipo | 74 |
| SHL JB | 83 |
| SHL KBK | 77 |
| DHP Mersing | 91 |
| DHP Tumpat | 91 |

| Lao-PDR | Assessment Score (%) |
|---|---|
| NCLE | 54 |
| Savannakhet | 69 |
| Luang Prabang | 67 |
| Luang Namtha | 14 |
| Sepol | 28 |

# Future plans

- Assessment of different level of laboratories (peripheral, public health and national reference including BSL-3 laboratories)
- Practical biosafety and biosecurity guidelines for hospital / public health laboratories
- Establishing proper national programme on bio-safety
- Periodical training program for biosafety and good laboratory practice
- Establishing laboratory network

# AI outbreaks



# Other Biosafety issues

- There are many labs that are not under MOH responsibility, e.g. agriculture, military, environment, commercial labs etc.
- There are double biosafety standards between FAO and WHO as far as HPAI is concerned.